

XXXVIII. *Notæ Dipterologicæ. No. 6.*—*On the minute species of dipterous insects, especially Muscidæ, which attack the different kinds of Cereal crops.*
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[Read November 2nd, 1881.]

PLATE XXII.

THE Cereal crops in this country occasionally suffer to a very considerable extent by the attacks of various minute species of dipterous insects belonging to the families *Tipulidæ* and *Muscidæ*. In the former family, the *Cecidomyia tritici* is especially injurious by depositing its eggs with the assistance of its long telescope-like ovipositor in the centre of the flower of the wheat when in blossom; the small yellow larvæ, hatched from which eggs, eating the pollen, and thus preventing the impregnation of the flower and rendering the ears abortive. The history of this insect was first detailed by the late Hon. President of our Society, the Rev. W. Kirby, in the third volume of the Linnean Transactions, p. 246 (1795), continued in vol. iv., p. 230 (1798), and in vol. v., p. 96 (1799).

The Hessian fly (*Cecidomyia destructor*, Say), fortunately not yet detected in England, and at first regarded as identical with the *C. tritici*, differs from that species in the habit of its larvæ feeding at the crown of the root of the wheat plants, or at the first joint within the sheath of the leaf, where whole clusters of the pupæ are to be found. Say, in Journ. Acad. Nat. Scienc. Philadelph. vol. i., p. 45; Asa Fitch, *The Hessian-fly*, in Trans. N. York Agric. Soc., vol. v. and vi.; and Kollar, 'Treatise on Injurious Insects,' translated by Miss Loudon, p. 118.

Another species of *Tipulidæ*, most probably also belonging to the genus *Cecidomyia*, was described by Dr. John Nep. Sauter, in Germar's 'Magazin der Entomologie,' and in Kollar's 'Treatise on Injurious Insects,' under the name of *Tipula cerealıs*, as injuring barley and spelt (a kind of dwarf wheat) in the Grand Duchy of Baden, the vermilion-coloured larvæ measuring one to one and a half lines in length, appearing in May and

June, and living gregariously between the leaf-sheath and the stalk, and eating the straw, which in consequence becomes warty, notched, and crooked, and afterwards dies.

Several minute species of the family *Muscidae* are also very injurious to our Cereal crops, which they attack, in their immature state as small footless larvæ, either by feeding upon the heart of the young plants when just above the surface of the ground, or at a later period of the year upon the young and juicy stems, or on the grains and pollen.

As unfortunately there is considerable confusion in the published accounts of the different species of these small *Muscidae*, and as the works in which such accounts originally appeared are for the most part of difficult access, and the abstracts which have been published of them by compilers have not been sufficiently precise, several of the most important memoirs themselves having been overlooked, it will doubtless be considerably useful to give a short account of the different species and their bibliography.

Oscinis Frit.

The first memoir on the Cereal insects was published by Linnæus in the Transactions of the Stockholm Academy, 1750, p. 128 (translated in the German edition of those Transactions, and published in Band 12, Hamburg and Leipzig, 1754, p. 187) with the title "Untersuchung der tauben Gerste" (barley).

The description of this insect is thus given by Linnæus :—

"*Musca Frit*, antennis setariis; pilosa, nigra; halteribus, plantis posticis abdomineque virescenti pallidis.

"Linn., Act. Stockholm, 1750, p. 128, ubi historiani dedi. Fauna Suecica, p. 456. (Syst. Nat., p. 994, No. 90).

"*Hab.* Intra glumas Hordei, granum facile decimum quodque destruens unde Frit s. Grana hordei viliora levioraque prognascuntur maximo damno agrorum." "dispendio annuo ultra 100,000 ducatorum aureorum."

Desc. Magnitudo Pulicis. Corpus figura *M. domesticæ* agilissimum quasi saltatorium nigrum. Oculi fusci. Plantæ posticiæ pallidæ. Halteres pallidi. Abdomen fuscum, subtus magis pallide virens."

The description given by Fallen (Diptera Suec. Oscinides, p. 7) is more precise :—

Corpus pulice sæpius minus, agile, nigrum nitidum, oculi maximi globosi. Caput antice convexum nigrum ; vertice brevissime setoso, macula magna triangulari nitidissima. Antennæ nigræ, seta geniculata. Pedes nigri, tarsis flavo-albis. Alæ abdomine longiores hyalinæ, nervis ut in reliquis hujus sectionis speciebus directis ; nervo scilicet 4to longitudinali cum nervo costali in apice alæ conjuncto nervisque transversis paullo distantibus. Halteres albi. *Venter in femina viva pallidus.*

Var. 2. Tarsis pallidis.

Var. 3. Alis nigricantibus tibiis tarsisque albidis in medio nigris.

Var. 4. Metatarso albo.

Obs. Ab Oscine maura vix differt nisi magnitudine minor antennarumque seta obscuriore nec distincte alba.

Zetterstedt, in the ‘Insecta Lapponica,’ col. 781 and ‘Dipt. Scandinaviæ,’ p. 2646, vol. xi., p. 4337, gives but a short description of *Oscinis Frit*, as follows :—

“Tota nigra, antennarum seta pedibusque concoloribus tarsis pallidis, alis hyalinis halteribus albis. Minutissima vix $\frac{1}{2}$ lin. long. tota nigra nitida halteribus tarsisque præsertim posticis tantum pallidis. In ceteris *O. pusillæ* similis. Oculi in vivo ænei. Varietas, metatarso tantum albo Fall. Dipt. Sv. Oscin. 7, 9, var. 4. Antennarum seta in hac specie nigra vel fusca est.

In the Appendix to his ‘Dipt. Scandinaviæ,’ vol. xi., p. 4479, Zetterstedt gives Fallen’s third variety of *Oscinis Frit* as = *Oscinis pusilla*, Zett., vol. vii., p. 2649.

In Mr. Haliday’s memoir on the identification of the Linnean species of Diptera published in the ‘Stettiner Entomol. Zeitung,’ 1851, p. 144, founded on an examination of the Linnean Cabinet of Insects at the Linnean Society, is the following observation :—“*Musca Frit* : drei exempl. auf Karte geklebt mit einer Puppe = *Oscinis vastator* and *granaria*, Curtis (*Musca hordei*, Bjerkander Act. Holm.).

Musca saltatrix.

Linn., Fauna Suecica, p. 555; Appendix, No. 2319; Syst. Nat., p. 988.

This insect is described by Linnæus as found "in campis inter gramina saliens more Cicadæ." The characters agree with those of a species of *Chlorops* which is very injurious to cereal plants, having the head yellow, with a black triangular spot on the vertex. "Thorax a tergo lineis tribus longitudinalibus nigris quarum intermedia cum capite cohæret, laterales vero a capite distinctæ. Scutellum flavum. Abdomen supra fuscum lineis duabus flavicantibus. Femora postica crassa." (Fn. Suec.).

The last-mentioned character is omitted by Linnæus in his 'Systema Naturæ,' as noticed by Mr. Haliday in his Paper on the Linnean Species of Diptera, published in the 'Stettiner Entomol. Zeitung,' 1851, p. 143; as follows:—

"*Musca saltatrix*, Linn. = *Chlorops tæniopus*, Meig.—Wahrscheinlich hatte Linné dies Stück vor sich, als er in der Beschreibung im Syst. Nat. (xii., 988, 60) den character "femora postica crassa" aus der Fn. Suec. welcher auf eine *Meromyza* Mg. deutet, ausliess.—Auch Geoffroy (Hist. ii., 508, 31; Ent. Paris, ii., 480, 32, *Musca saltatrix*) beschreibt einen *Chlorops*, Mg."

Fallen thus describes the *Oscinis saltatrix*, "Linn., Fn. 2319, vera":—

"Pallide virescens, thorace nigro-tri-lineato; abdomine trifasciam nigro punctato, femoribus posticis crassissimis."—Diptera Suec. Oscin., p. 3.

Zetterstedt ('Diptera Scandinaviæ,' p. 4337), observes, under *Oscinis tæniopus*:—

"*Osc. tæniopus* (*Chlorops ead.* Meig.), in Mus. Linneano sub nomine '*Musca saltatrix*' occurrit (teste Haliday, Ent. Zeit., 1851, p. 143), qui non sine ratione putat Linneum hoc individuum ante oculos habuisse describentem suam Muscam saltatricem in Systema Natur. xii., p. 988, 60 ubi nota illa characteristica 'femora postica' (in 'Fauna Suecica' allata) exclusa fuit."

In a memoir published in the Transactions of the Stockholm Academy for the year 1777 (German edition, vol. xxxix., Leipzig, 1782, p. 29 *et seq.*), by Clas Bjerkander, entitled "Vom Wurzelinsecte," are contained descriptions of a number of small *Muscide* which have been overlooked by subsequent writers. The first of these is—

Musca secalis (p. 30), the larvæ of which injure the young rye plants:—

"Die Fliege ist etwas kleiner und dünner, als die gewöhnliche Stubenfliege. Der Leib aschgrau, dünn, mit schwarzen Haaren bekleidet. Die Augen braun, um sie weisse Ränder. Der Rüssel schwarz. Die Füße haaricht, die ersten Gelenke wie der Körper, die andern schwarz. Die äussersten Enden weiss. Die Flügel roth und grün glänzend. Der Unterleib hat vier Gelenke. Die Balancirstange weiss. Zwischen den Augen kleine Fühlhörner, mit auswärts sitzenden schwarzen Haaren.

"Die Made ist fast weiss, zwo Linien lang, der Kopf spitzig, zu äusserst schwarz, einem solchen Striche V ähnlich. Ohne Füße; 10 Ringe. Das andere Ende, oder der Schwanz ist gleichsam quer abgeschnitten, doch etwas ungleich. Wegen Mangels der Füße, kriecht sie nur durch Bewegung der Ringe fort, nachdem sie solche ausstreckt, oder wieder zusammenzieht."

The larvæ remained in that state through the winter, passing to the pupa state at the end of May, and the flies appeared from the 19th to the end of June.

Another species, also injurious to rye, is described by Bjerkander in the same memoir under the name of—

Musca calamitosa, Bjerk., *op. cit.*, Germ. ed., xxxix., 32.

"Die Fliege ist sehr klein, Kopf, Brust und Schenkel, schwarz. Hinterleib röthlich, glänzend, mit fünf Ringen. Die Fühlhörner sind anfangs ein kleiner Knoten, wie das kleinste Sammkorn, daran einige kleine Haare sitzen. Die Flügel reichen über den Körper hinaus, liegen an einander, dass sie ein Oval ausmachen, und glänzen röthlich.

"Der Schaden, den die *M. secalis* verursacht, ist an der zarten und nur aufgegangenen Rockensaat sehr sichtbar, sie fällt um und verfault. Aber etwas verborgner ist die Niederlage, welche die hier nachfolgende

Made verursacht, die später im Herbst, wenn die Rockensaat viel Aestchen angesetzt hat, die zärtesten Blätter abbeisst, die zuletzt gewachsen sind, welche sich gleichfalls noch in den Hülsen befinden, und nur an den äussersten Enden gelb werden, aber wegen der zunehmenden Kälte nicht eher gänzlich vertrocknen, als im folgenden Frühjahr.

“Die Made, von der ich nur jetzo geredet habe, ist gelb, anfangs sehr klein, wie ein Mannakorn, sie wächst aber, dass sie im November eine Linie lang ist. Ihr Kopf ist spitzig, und hat so einen schwarzen Striche V. Aus der Puppe kam *M. calamitosa*.”

Musca hordei, Bjerk., *op. cit.*, Germ. ed., xxxix., 33.

“Kopf und Vorderleib schwarz, Hinterleib und Füsse grau. Die Flügel länger als der Leib, und weiss, mit drei Adern. Die Fühlhörner schwarz, klein, spitzig, $\frac{1}{2}$ Linie lang. Die Fliege ist sehr klein.

“Die Made weissgelb, über 1 Linie lang, am hintern Ende quer abgeschnitten. Der Kopf spitzig, etwas schwarz, mit dem Striche V. Aus den Maden wurden im Jul. 1776, Fliegen. Die Maden hatten das Frühjahr zuvor meist zur Hälfte an einigen Oertern die Rockensaat verderbt.”

In a footnote to the preceeding memoir, Bjerkander describes four other new species of *Muscidae* which he had reared, preceded by the following memorandum, and which have remained unnoticed by Dipterologists:—

“Maden, die beym hereinbringen von der Rockensaat so sehr klein waren, dass man sie nicht so genau, als man wünschte, unterscheiden konnte, sind noch mehr kleine Fliegen geworden, die hier nur nach ihrer Verwandlung kürzlich beschrieben werden.”

“1. *Musca velox*, Bjerk., *op. cit.*, Germ. ed., xxxix., 32.

“Die Fliege eine Linie lang. Kopf schwarz, unten grau. Der Hinterleib hat 4 Ringe, röthlich, am Ende spitzig. Die Flügel liegen an einander. Die Füsse zunächst am Körper gräulich, die äussersten Gelenke schwarz.

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“2. *Musca tripunctata*, Bjerk., *op. cit.*, Germ. ed., xxxix., 33.

“Vorderleib und Brust schwarz. Der Körper haaricht, die Augen braun. Der Hinterleib grau, länglich, mit 2 schwarzen Flecken unten in einer Linie, zu äusserst schwarz. Die Füsse lang, und die vordern weiss an den Enden. Die Balancierstangen weiss. Die Fliegen fingen den 9 Febr. 1776, im Glase aus der Puppe zu kriechen an. Sie zeigten sich zuerst im Junius in den Düngerhaufen.

“3. *Musca truncata*, Bjerk., *op. cit.*, Germ. ed., xxxix., 33.

“Der ganze Körper schwarz, etwas über eine Linie lang. Die Fühlhörner kurz, Perlenschnurähnlich. Der Hinterleib glänzend, wie schwarz Glas, rund, und gleichsam quer abgeschnitten. Die Füsse gelblich. Die Flügel länger, als der mittlere Leib, liegen an ihm an, aber so, dass die innern Seiten einander nicht berühren, sondern ein wenig Raum zwischen sich lassen. Sie krochen im Glase um den 29 Jun. 1776, aus.

“4. *Musca nivalis*, Bjerk., *op. cit.*, Germ. ed., xxxix., 34.

“Eine Linie lang. Die Augen gross und grün. Die Fühlhörner klein mit einigen Haaren am Ende. Der Vorderleib auf dem Rücken haaricht, unten gräulich. Der Hinterleib hat fünf Ringe, glänzend grün. Die Flügel reichen über den Leib hinaus, liegen im Oval, und glänzen roth. Im Glase kamen die Fliegen um den 20 Jun. hervor. Im Nov. 1776, war einmal 13 Grad Kälte, und 4 Zoll tiefer Schnee, gleichwohl fand man diese Fliegen beym Thauwetter unter der Rockensaat den 17 Dec. lebend.”

Clas Bjerkander, in another memoir published in the Transactions of the Stockholm Academy for the year 1778, vol. xxxix., pp. 240 and 241 (Germ. ed., vol. xl., p. 231, ‘Die Rockenzwergmade’), has a short memoir on another insect which attacks the rye, and, as the species has been much confused, I have thought it better to give the following translation of this memoir:—

Musca pumilionis.

In the month of May I observed, among the plants of rye, some dwarf shoots one or two inches long, on

examining which a small worm or larva was found at the first joint, which had caused this singular enlargement. To observe the transformations of these worms, I placed several in a glass bottle. The larva is white, two lines long, ten-jointed; the head pointed, black at its extremity, with a V-like mark. It changed to a chrysalis on the 25th May. This chrysalis is yellow, shining, rather more than a line long, flat, and ringed. The flies began to make their appearance on the 12th June. The perfect insect is rather more than a line long. Its head is yellow, eyes black; it bears on the vertex a black triangle. The black antennæ are somewhat nodose, with some hairs. The thorax is black above, marked with two yellow longitudinal lines, beyond which, near the abdomen, is a yellow crescent-like spot (scutellum). The under side of the thorax is yellow. The fore legs have two black spots. The abdomen is black above, yellow beneath, and four-jointed. The balancers are white; the wings are glossed with red and green, and extend a little beyond the body. The portion of the legs next the body is greyish, with the extremities black. The fly may be named *Musca pumilionis*. We are still ignorant whether the eggs are laid on the stems of the rye. On the 23rd April the larvæ were still small, and they attained their full size by the 25th May. As there is no hole visible at the side of the straw, it would appear that the eggs or larvæ are deposited on the leaves. When holes are there found, they are made by the larva of *Phalæna secalis* or by some other insect. When the fly emerges from the chrysalis-skin it creeps to the top of the sheath and makes its escape. The stunted rye plants, beginning to assume a yellow colour and dry about the 14th July, were so numerous in some fields that as many as from eight or twelve to fourteen might be counted in a space of four square feet; hence may be seen how great is the mischief they produce, which may be prevented by cutting up and burning the infested plants, and thus destroying the enclosed insects. I have thus cut up as many as 350 shoots.

Fabricius (Syst. Antl., p. 216), simply observes of *Musca pumilionis*, "Habitat in Secalis, Triticuli culmis, quos omnino destruit"; but Fallen, in the 'Diptera Succica, Oscinides,' p. 7, gives a more detailed description and the following explanatory note:—

“Flavescens; thoracis dorso nigro, flavo bilineato; nervo costali cum nervo 4to longitudinali in apice alæ conjuncto.

“Larva in culmis secalis quos destruit vitam degit a Cl. Bjerkander *l. c.*, descripta. Descriptio autem imaginis in *Oscinem* et *lineatum* et *Pumilionis* omnino quadrat, nulla ibidem facta de situ nervorum in alis commemoratione. Larva quoque utriusque speciei in culmis segetum s. graminum habitare verisimillimum est.

“Individuum autem e larva culmi secalis natum quod b. m. Bjerkander cum cel Prof. And. Lidbeck communicavit, a nobis lustratum, totum nigrum non hujus est speciei sed *Oscinis Frit*.

“Quin igitur Cl. Bjerkander et larvas plurium *Oscinis* specierum, in culmis forsitan cohabitantes exclusisset et differentiam unius tantum speciei descripsisset, vix dubitanus.”

In the year 1780 M. Bjerkander discovered a small Muscoid insect injurious to oats previously unknown, of which he gave an account in the Transactions of the Stockholm Academy, new series, for the year 1781 (German edition, 1784, vol. ii., p. 173). As this memoir has been entirely overlooked by subsequent writers, it is here reprinted from the German translation:—

“Die Made ist gelblich, etwas über 1 Linie lang, am Kopfe spitzig, hat keine Füße. Die Puppe braun, länglich. Den 14 Jul. kam die Fliege zum Vorschein.

“*Musca Arena*. Die ganze Fliege schwarz, glänzend, die Augen bräunlich; die Fühlhörner ein Knoten, von dem einige Haaren ausgehen. Der Hinterleib hat 5 Ringe. Die Flügel reichen über den Körper hinaus, liegen in einer Ovale, und glänzen von rothen und grünen Farben. Die Länge, meist 1 Linie.

“Diese Fliege ist der *Musca Frit* und der *Musca hordei** etwas ähnlich, es ist aber nicht wahrscheinlich dass ein und dasselbe schädliche Thier so vielerley Schaden, und das zu so unterschiedenen Zeiten thun sollte.

“Wenn der Haber anfängt Halme zu bekommen, fangen die Maden an, sie abzuschneiden, erst am untersten Gliede dann an den übrigen. Nur der letzte Schaden, den sie thun, wird dem Landmanne merklich, weil die *panicula* vertrocknen und weiss werden.”

* Reference to Linn., Act. Holm., 1750, 189.

A note is added relative to *M. Frit* and *M. hordei*, which Bjerkander regards as identical.

The following communication, dated September 15th, 1881, from J. B. Yonge, Esq., of Otterbourne, Winchester, addressed to myself, introduces us to a minute species of *Muscidae*, which, from the vast number of specimens observed, must evidently be very injurious to the crops of oats :—

“SIR,—You may perhaps be interested in an unusual abundance of insect-life that has just occurred here. Mr. Dennis, one of the farmers, lately threshed about twenty-five quarters of oats in the field, and stored the grain in bulk in a loft. A few days afterwards a stratum of flies was seen on the top of the oats, coming up among them, and passing away through the windows. The stratum was about four feet long, one broad, and three inches thick, and being continually renewed from below as those above passed off, an immense number must have gone through during the four days it was observed. I enclose a bottle containing a few [about 100] specimens. *The grain does not appear to be injured.* There are a quantity more of the same oats in a rick in the field where they were grown. Would you kindly tell me what is the species of fly, and what its habits, and the food of the larva? Whether it is one of those injurious to corn? and if it would be prudent for the farmer to thresh out the rest of the oats as soon as he can for fear of damage by the maggots; or if there are any other precautions that would be prudent in order to destroy the eggs?”

In Kirby and Spence's 'Introduction to Entomology' (small edition, p. 95), the only insects which attack the oats are said to be the omnivorous wireworm (or larva of *Elateridae*), and occasionally an Aphis; and Mr. Curtis, in his 'Farm Insects,' mentions *Leucania obsoleta* and *Crioceris melanopa* as feeding on the leaves of standing oats, and that the oat crops in Styria and Carinthia occasionally suffer from the attacks of the larva of a minute *Tipula* or *Cecidomyia* on the grains. Mr. Markwick also found a larva which he considers as that of the wheat midge in the husks of the wild bearded oat, *Avena fatua* (Linn. Trans., iii., p. 246).

Many of the flies which accompanied Mr. Yonge's communication to me were still alive. They are very

minute, being only about one line in length, and about $2\frac{1}{4}$ lines in the expanse of the wings. They are black, slightly glossy, and with a very little brassy tinge; the halteres are whitish, the legs entirely black, the wings colourless, or but very slightly ashy coloured, with dark slender veins. The forehead is elevated and rounded, the face slightly emarginate in its profile in front of the eyes, for the reception of the antennæ, which have the principal joint short and semi-rounded, with a slender and slightly setose dorsal bristle or terminal joint. The mouth is a beautiful microscopical object, with two clavate, setose palpi, a strong, short, pointed, horny tongue, and a large fleshy lip notched in the middle of its terminal margin so as to form two lobes, each of which is traversed by three fine curved transversely striated muscles.

This species, although closely allied to *Oscinis vastator*, Curtis ('Farm Insects,' p. 239, pl. H, fig. 11r), differs in the colour of the legs, which in the latter insect have the base and tips of the four anterior tibiæ ferruginous, the base of the first joint in all the tarsi of the same colour, whilst the legs are uniformly black in Mr. Yonge's insects. From this slight difference I was led to infer that the habits of the latter were identical with those of Mr. Curtis's insect, and that its larva fed on the stems of the oats. This supposition was, however, contradicted by the fact that the flies had only made their appearance after the grain had been threshed out in the field and the oats stored in the loft. At all events, the mischief, whatever it might have been (and Mr. Yonge says that the grain did not appear to be injured), had been done, and no more damage was to be apprehended from the flies, which were making their appearance in such incredible numbers. Finding, however, in the bottle which contained the flies, two or three grains of the oats, I opened them carefully, and found, within the enveloping scales of one of the grains, the remains of an *Aphis*, and within another (in which the grain itself had disappeared) there remained only the shrivelled feathery styles of the ovary, above which was the empty scaly elongate-ovate covering of the puparium of one of the little flies, which had left the grain and joined its companions in their escape from the loft. Thus the cause of the appearance of these flies after the grain was housed was accounted for, and the species was proved to

agree with *Cecidomyia tritici* in the habit of feeding upon the young grain, and not within the stem of the plant like the *Chlorops lineata*. Hence we learn that, instead of the housed grains being uninjured, as was stated, each fly must have destroyed one of the oat-grains, remaining within the scales until the crop had been housed. Hence, too, we also learn that if it were possible to submit the grain, as soon as threshed, and before being housed, to the action of a degree of heat sufficient to kill the flies without injuring the grains, the chances of next year's crop of oats being freed from the ravages of the insect would be greatly increased.

The insect before us appears to me to be identical with the *Musca avenæ* of Bjerkander, and with *Oscinis atricilla* of Zetterstedt ('Ins. Lapponica,' col. 781, No. 11*). The latter is the only one of the sixty species of the genus described by Meigen, Fallen, or Zetterstedt, with which it can be compared.

O. atricilla is stated by Zetterstedt to have the greatest resemblance to *O. pusilla*,† which, I believe, is identical with the *Oscinis vastator* of Curtis, differing in being blacker and less metallic in colour, and in having the anterior tibiæ and tarsi blackish brown, whereas they are black in my insects.

The 'Transactions of the Linnean Society of London' (vol. ii., p. 76, 1794), contain a memoir entitled "Some Account of the *Musca pumilionis* of Gmelin's Edition of the 'Syst. Naturæ.' By William Markwick, Esq. With additional remarks by T. Marsham, Esq." Early in spring some fields of wheat near Battle appeared to be much blighted, the injury being caused by a small grub lodged in the very heart of the stem just above the root; from some of the diseased plants placed in a flower-pot, and covered with gauze, several small flies were produced. The plants thus attacked threw out

* *Oscinis atricilla*, Zetterstedt, 'Insecta Lapponica,' col. 781, No. 11.

Tota nigra, antennarum seta pedibusque concoloribus, alis hyalinis, halteribus albidis. Mas, fœm.

Magnitudo et summa præcedentis (*O. pusilla*) similitudo, a qua non differt nisi colore magis atro, vix metallice nitente, et pedibus totis nigris, tibiis tarsisque anterioribus nigro-fuscis.

† *O. pusilla*, Zett., l. c., col. 781, No. 10. Subænescenti nigra tota, antennarum seta concolore, tibiis anterioribus tarsisque omnibus pallidis; alis hyalinis, halteribus albis. Mas, fœm.

side shoots abundantly, thus *stocking* themselves, as the farmers term it. No precise description of the insect was given, but in the accompanying plate the insect was represented in its different states, exhibiting the head of the fly marked with a triangular black spot; the thorax black, with two yellow longitudinal streaks; the scutellum yellow, and the abdomen pale-coloured. The subsequent proceedings of the fly and its progeny were not described. From Mr. Marsham's supplemental note it appears that Sir Joseph Banks had also reared the fly from the roots of diseased wheat, and had determined it to be identical with the *Musca pumilionis* of Bjerkander, and by letter communicated the information to Mr. Arthur Young, accompanied with an engraving of the fly, both of which were published in the 91st number of the 'Annals of Agriculture.' Mr. Marsham comments on Bjerkander's account, and speculates on the subsequent proceedings of the fly, which he recommends to the observation of farmers, shrewdly adding that, as the plant throws off side shoots abundantly, Bjerkander's advice to pull up and burn the damaged plants cannot be considered as judicious.

In the year 1812 the Agricultural Society of the Seine was officially consulted by the Minister of the Interior on the subject of the very extensive injury to cereal crops in different parts of France, and especially in the neighbourhood of Paris, by the attacks of insects. The celebrated entomologist M. Olivier was accordingly charged by the Society to investigate the history of the insects in question, and he published a *first* memoir on the subject in the 'Actes de la Société,' tom xvi., p. 447. His death, however, prevented his further researches, and those of M. Victor Audouin, who subsequently undertook to prosecute the subject, were in like manner cut short by the premature death of the latter.*

Olivier (Mém. sur quelques insectes qui attaquent les Céréales) gave short descriptions and excellent figures of several of these species of cereal *Muscidæ*, which (with one exception), have been overlooked by subsequent

* It is greatly to be regretted that the numerous volumes of observations on the economy of many species of insects made by M. Audouin, accompanied by excellent drawings, still remain unpublished.

systematic Dipterologists. The first of these is named *Chlorops pumilionis* (p. 4, pl. i., fig. 2), and is identical with the insect figured by Guérin as *Chlorops lineata*. Olivier reared it from cereal plants which he had placed in bottles in April in the preceding year. "C'est le Diptère qui est sorti le plus abondamment des tiges du seigle, et de l'orge qu'elle paroît attaquer plus particulièrement que les froment, quoiqu'elle se trouve aussi quelquefois dans ces derniers."

Tephritis Hordei.

Olivier, Mém. sur quelques ins. qui attaq. les Céréales, p. 12, pl. i., f. 1.

"Antennis plumatis; nigro-ænea, capite argenteo, palpis flavis. Long. 3—4 mill.

"Antennes noires; corps noir bronzé, légèrement couvert d'une poussière imperceptible grise. Tête et thorax avec des poils roids, noirs, assez longs; yeux vert brillant un peu foncé, noirâtres après la mort. Tête couverte d'un léger duvet argenté; ailes transparentes, un peu irisées, balanciers jaunes."

Reared in a bottle in which diseased plants of barley, rye, and wheat had been placed at the beginning of April.

Oscinis flavipes.

Olivier, Mém. sur quelques ins. qui attaq. les Céréales, p. 14, pl. i., fig. 3.

"Nigra; abdomine basi rufo; pedibus flavis (cuisses presque entièrement noires). Long. 2 mill."

Two individuals reared in a bottle in which diseased plants of barley, rye, and wheat had been placed at the beginning of April.

Oscinis nigra.

Olivier, Mém. sur quelques ins. qui attaq. les Céréales, p. 15, pl. i., fig. 4.

Corpore nigro, immaculato. Long. vix 2 mill.

"Filet des antennes simple. Corps noir, luisant, à l'exception des balanciers qui sont d'une jaune obscur."

Reared in a bottle in which diseased plants of barley, rye, and wheat had been placed at the beginning of April.

Tephritis pallisa.

Olivier, Mém. sur quelques ins. qui attaquent les Céréales, p. 15, pl. i., fig. 5.

Corpore pallide cinereo, antennis plumatis. Long. vix 2 mill.

“Corps couvert de quelques poils longs, d’un brun clair ; les balanciers sont de la couleur du corps ; les ailes sont proportionnellement un peu longues que dans les autres espèces, et ont un reflet irisé.”

Reared in a bottle in which plants of barley, rye, and wheat had been placed at the beginning of April.

Leptocera nigra.

Olivier, Mém. sur quelques ins. qui attaquent les Céréales, p. 15, pl. i., fig. 6.

“Nouv. gen. Par la longueur du filet des antennes il se rapproche du g. *Trineura*, mais les deux premiers articles sont bien distincts, tandis qu’ils ne forment qu’une boule dans les *Trineura*. Dans la *Trineura* les trois nervures longitudinales vont de la base à l’extrémité sans qu’on aperçoive aucune nervure transversale. La disposition des ailes dans le n. g. dont les nervures internes ne vont point jusqu’à l’extrémité, et s’arrêtent au milieu, et où l’on voit de plus deux nervures transversales, l’éloigne aussi des Tephrites, des Oscines, et des Mouches, avec lesquelles ce genre a quelques rapports par la forme du corps et celle des deux premiers articles des antennes.

“*L. nigra* : ore pedibusque fusco-rufescentibus. Long. 2 mill. Antennes noires, le filet long, très-menu, simple, la tête est noire en dessus, le front et la bouche sont d’une couleur de brique obscure ; le corps est noir garni de quelques poils ; on en voit deux ou trois sur l’écusson plus longs et plus forts que sur le reste du corps ; les balanciers sont de la couleur des pattes. Les ailes diffèrent de toutes celles des autres diptères ; la seconde cellule placée vers le milieu est fermée, et les deux nervures qui devoient se prolonger jusqu’à l’extrémité des ailes sont à peine commencées.”

Seven specimens reared in a bottle in which diseased plants of barley, rye, and wheat had been placed at the beginning of April.

In the 'Mémoires de la Société d'Agriculture du Département de la Marne,' for the years 1837, 1839, and 1841, M. Dagonet, of Chalons, published a series of articles on insects injurious to cereal plants, accompanied by rude figures, in which he gave a general account of the economy of the species of *Chlorops* which causes the swollen stems of the wheat, to which he applies the name of *Musca pumilionis*. His observations, however, are not so complete and descriptive as those of M. Herpin.

The observations of Olivier were subsequently resumed by M. Herpin, of Metz, whose memoir was published in the "Mémoires de la Société royale et centrale d'Agriculture, Année 1842." In that memoir M. Herpin described the economy of the following insects: "1, De l'Oscine ou Chlorops du froment et du seigle; 2, Oscine ou Chlorops de l'orge; 3, le Sirex ou Cephus du froment et du seigle; 4, De l'Apion ou Charançon du trèfle; 5, De l'Alucite ou la Teigne des blés; 6, De la Noctuelle et de la Cecidomyie des céréales."

The first of these insects appeared to M. Herpin to be identical with Olivier's No. 1, but various important details in its history were observed for the first time by the later writer. The plants attacked by the larvæ in the winter and early spring become yellow and die, the larvæ, which had eaten the heart of the plant, transforming to the chrysalis state, from which the perfect insect is developed at the end of April or beginning of May. The writer proceeds:—

"L'accouplement de l'Oscine sortie des jeunes plantes de seigle et de froment a lieu vers la fin de Mai ou au commencement de Juin. La femelle s'occupe aussitôt à faire sa ponte sur les tiges du froment qui commence alors à monter en épis; elle dépose un œuf vers la partie inférieure de l'épi, au fond des cannelures des feuilles. Environ quinze jours après la ponte, il sort de cet œuf une larve oblongue, jaunâtre et sans pattes, qui s'attache à la tige de la céréale, immédiatement au-dessous de l'épi; elle se nourrit en rongant une partie de la surface de chacune qui est alors très-tendre; elle y trace et y creuse un sillon extérieur de 2 millimètres environ de largeur, de 1 millimètre ou 2 au plus de profondeur, mais qui ne pénètre jamais jusque dans le canal intérieur de la tige. Ce sillon s'étend depuis le bas de l'épi jusqu'au premier nœud supérieur, sauf quelques exceptions, lorsque, par exemple, la larve vient

à périr ou qu'elle a pris tout son développement avant d'avoir atteint le premier nœud. Arrivée près de ce point la larve a ordinairement acquis toute sa croissance ; alors elle se transforme en nymphe ou chrysalide, et se fixe le plus souvent vers la partie moyenne du sillon qu'elle a creusé à l'extérieur de la tige. Dans le mois de Septembre suivant, il en sort un Diptère du genre *Oscinis* d'Olivier ou *Chlorops* de MM. Meigen et Macquart, que peut vivre pendant plusieurs semaines, et va déposer ensuite sa nouvelle ponte sur les seigles et les blés tout récemment semés. Les tiges du froment attaquées par les larves provenant de la deuxième ponte du *Chlorops* présentent des altérations tellement singulières et remarquables, qu'il est surprenant que l'on n'en ait pas jusqu'à présent reconnu la cause ; ces altérations sont généralement attribuées à un vice de la végétation ; occasionné par certaines intempéries des saisons. Les tiges ainsi attaquées n'ont guère que la moitié de l'hauteur des tiges de blé qui sont saines, leur maturation est retardée considérablement ; elles sont encore très-vertes lorsque les autres sont devenues jaunes par l'effet de la maturité ; l'épi n'est pas encore sorti d'entre les feuilles qui l'engainent ; il est court, peu volumineux, peu abondant en grains ; ceux-ci d'ailleurs sont maigres, retraits et racornis ; enfin tous les épillets situés du côté où se trouve le sillon longitudinal creusé par la larve sont entièrement avortés, et ne contiennent aucun grain."

The species observed by M. Herpin is attacked by Hymenopterous parasites of the genus *Alysia*.

The "*Oscinis* ou *Chlorops* de l'orge" (*Hordeum distichon*) is considered by M. Herpin (Mém., p. 18), to be identical with the *Musca Frit* of Linnæus. It "paraît être le même que celui qui dévore les tiges du blé ; il y produit les mêmes altérations et creuse à l'extérieur de la jeune tige un sillon longitudinal au dessous de l'épi."

M. Herpin further observes:—"Outre cet insecte (*Chlorops* de l'orge) l'orge est attaquée par les larves d'un autre *Chlorops* bien plus petit que le précédent, qui sont au nombre de six à dix dans chaque épi, elles rongent les organes sexuels des fleurs, et font avorter la fructification de telle sorte que les épis sont tout à fait stériles. Souvent aussi on trouve sur le même pied d'orge le premier *Chlorops* qui ronge la partie supérieure de la

tige, et plusieurs autre petits *Chlorops* de la second espèce qui dévorent l'épi. Ces deux espèces se comportent, pour leurs métamorphoses, de la manière qui a été indiquée plus haut."

The Memoir of M. Herpin was accompanied by a Supplemental Memoir by M. Guérin-Ménéville, illustrated with six coloured plates. In this memoir the first species described by M. Herpin, and incorrectly referred by Olivier and Dagonet to the *Musca pumilionis* of Bjerkander, was affirmed to belong to the genus *Chlorops* ("tandis que l'autre est une *Oscinis*"), and was described under the name of *Chlorops lineata*.* "Flavicans; antennis, vertice macula triangulari, thorace vittis quinque nigris; abdomine flavo, fasciis punctisque duobus basalibus fuscis, ano flavo, pedibus flavis, tarsis anticis nigris, intermediis et posticis flavis, duobus articulis ultimis atris. L. 0.0004; l. 0.001 $\frac{1}{4}$."†

The second species, whose habits were noticed by M. Herpin, was described by M. Guérin (Mem., p. 30) under the name of *Chlorops Herpini*, "Flavicans; antennis nigris vel flavis, margine antico setaque nigris, vertice maculis duabus nigris triangularibus; thorace vittis tribus latis nigris; abdomine flavo, fasciis punctisque basalibus fuscis, ano nigro; pedibus flavis tarsis omnibus fuscis. L. 0.003; l. 0.001."

* *Oscinis lineata*, Fabr. Antl., 215, 4; Latr., Le Règne, An., p. 647; *Musca l.*, Fabr., Ent. Syst., p. 356, 180; Fallén, Dipt. Suec. Oscin., p. 4.

† ♂ et ♀. Larva in caulibus cerealibus, quos destruit, habitat. Conf. auctores citati. Imago in agris demessis copiosissime.

"Flavicans, thoracis lineis tribus nigris subcoherentibus; pedibus simplicibus."

Olivier, Mém. sur quelques insectes qui attaquent les Céréales, p. 4. "Obtenu des tiges de froment presque mûres."

† The following synonyms were added:—

Musca flava, Linn., Fn. Sv. 327; Geoffroy, ii., 537.

M. lineata, Fabr., De Vill., Schellenberg; Latreille (N. Dict. d'hist. nat., &c.); Olivier (Enc. Meth., viii., 35); Fallén, Dipt. Succ. Oscin., p. 4.

Oscinis pumilionis, Olivier, Mem. Soc. r. Agric. Dagonet, Mém. Soc. Agr. Marne, 1841.

Chlorops nasuta, Meigen, Macquart, Hist. Dipt. ii., 592.

C. tanipus, Meigen (var. præced.)

C. glabra, Westwood, Gard. Mag. xiii., 289.

The synonymy of these quotations was discussed at great length by M. Guérin.

In Loudon's 'Gardener's Magazine,' vol. xiii. (1837), p. 289, I published an article on wheat-flies, giving an abstract of the memoirs of Bjerkander, Markwick, Marsham, Fallén, and Olivier, and recording the fact that I had received from Mr. Raddon, about the middle of April preceding, several species of a *Chlorops* in the winged state (which I considered to be identical with the *C. glabra* of Meigen, but which is certainly the same insect as is figured by Olivier as *O. pumilionis*, by Curtis as *C. teniopus*, and by Guérin as *C. lineata*), which had been found in great profusion amongst wheat whilst removing it from the rick in which it had stood through the winter. This is an important point gained with respect to the economy of these flies, showing that the pupæ must have been carried with the upper part of the straw to the rick where the flies had hatched, either in the autumn or early spring. The former is more probable (the flies remaining in the rick till the spring), because it is of common occurrence to observe these little flies in our apartments during the autumn, at which period, in 1834, "they literally swarmed in the houses in the immediate neighbourhood of the metropolis, the white ceilings of rooms appearing quite discoloured by their numbers" (p. 293).*

In this article I further mentioned that I had received, from D. Sharp, Esq., F.L.S., a fly twice the size of those from Mr. Raddon, which he had reared from wheat in Huntingdonshire, that was attacked when six or eight inches out of the ground by the larvæ, which devoured the centre of the stem, and so killed the plants. It is not shining like the *Chlorops* from Mr. Raddon, and the yellow marks on the thorax are less conspicuous; the tips of the femora, as well as the tibiæ and tarsi, are brown. The veins of the wings are arranged as in Mr. Raddon's *Chlorops*.

In Dr. Lindley's 'Gardener's Chronicle' for 1848, pp. 780 and 796, I published two articles on wheat-flies, especially describing their attacks on the wheat plants, causing swellings of the base and centre of the plants.

There are also articles in the last-mentioned work for 1846, p. 596; and 1856, p. 158, by Mr. Curtis.

* In the Berlin. Ent. Zeitschrift, t. i., p. 172, 1857, large swarms of *Chlorops nasuta* are described.

Notes on *Chlorops lineata* by Isidore Pierre, with a report thereon by Milne-Edwards, appeared in the 'Comptes Rendus' of the Académie of Paris for 1848.

An article by the late Andrew Murray on *Chlorops tæniopus* appeared in the 'Gardener's Chronicle,' 1870, p. 1578.

In the valuable series of articles published in the 'Journal of the Royal Agricultural Society of England' by the late Mr. Curtis, subsequently republished in his fine volume, 'Farm Insects,' Chapters viii. to xi., are devoted to various insects injuring the corn crops. The memoirs of Bjerkander, Markwick, Herpin, Guérin-Ménéville, and Dagonet are abstracted, and an account of the mischief done by the insects figured by Olivier, and Guérin-Ménéville, as *C. lineata*, and by myself as *C. glabra*, is given under the name of *Chlorops tæniopus*, the writer doubting whether the insect is a variety of *C. lineata*, as supposed by Guérin. Mr. Curtis adds descriptions and figures of a very small black species of *Oscinis*, to which he gives the name of—

Oscinis vastator ('Farm Ins.,' p. 239).

The larva is very small, and feeds in the stem of the wheat plants, and, on the 5th and 20th July, perfect flies were produced. "This appears to be a much more formidable enemy than the *Chlorops*, for the ten or twelve stalks I opened were filled only with powder at the base, every portion of the young ear being consumed."

The length of *O. vastator* is three-quarters of a line, and the expansion of the wings two lines. It is shining greenish black, a large shining triangular space on the crown; face smooth and not concave, as in *Chlorops*; thorax globose, quadrate, with a scarcely visible ochreous pile, forming very indistinct lines in perfect specimens, and an impression on the disc; scutellum semi-ovate, terminated by two bristles, and finely rugose; abdomen short, not so broad as the thorax, rather depressed, ovate-conic, and five-jointed; wings transparent and iridescent, but slightly smoky, the costal nervure extending beyond the submarginal one to the mediastinal nervures; all the nervures pitchy, the two transverse ones not very remote; balancers with an oval ochreous club; legs longish and slender; base and tips of the four anterior tibiæ ferruginous; in the male the base of the first joint in all the tarsi is of the same colour.

According to Mr. Haliday this insect is identical with the *Musca Frit* of Linnæus. It is certainly closely allied to *Oscinis pusilla* of Fallén and Zetterstedt.

Oscinis granarius, Curtis ('Farm Ins.,' p. 298).

Black and shining, with a greenish cast; head transverse, semi-orbicular; antennæ black and orbicular, with a short pubescent seta. Eyes large, remote, oval; thorax nearly quadrate; scutellum semi-globose; abdomen of the female ovate-conic, apparently 5-jointed; wings transparent, iridescent; nervures dark, exactly like *O. vastator*; balancers with ochreous white club; legs black (?), the first pair lost, four posterior, with the basal joint of tarsi, dirty ochreous, and tip of intermediate tibiæ of same colour.

Reared from a grain of wheat of a rosy colour, from which the farina had been squeezed out possibly in picking it from the ear. It was of a pink colour, and from amongst it protruded an empty pupa-case of a rusty ochreous colour, from which the fly had been produced.

Distinguished from *O. vastator* by the base of the shank being black instead of ferruginous.

"Neither is it the *Musca Frit* of Linnæus, which I doubt not is a *Chlorops*."

Oscinis pusilla, Meigen.*

In a memoir published by Herr Kuhn in the 'Mittheilungen des landwirthschaftlichen Centralvereins für Schlesien' (1859), x., p. 135, an account is given of the injury committed by this little species on rye and white wheat. "Sie lebt in Gesellschaft mit *Musca Frit*, *Cercris*, &c., mit welcher in ihrer Wintergeneration aus Roggen und Weizenpflänzchen erzogen wurde, und kommt entschieden mit ihr auch an Wiesengräsern vor."

M. Boisduval ('Les insectes nuisibles,' 1862, p. 282), describes the history of *Cecidomyia tritici* and its parasites, *Oscinis vastator*, Curt., *Chlorops lineata*, Guér., *C. teniopus*, Meig., *C. Herpini*, and *C. pumilionis*.

* "Nigro-ænea, femoribus nigris tibiis tarsisque pallidis; scutello plano. Wahrscheinlich ist diese Art, *Oscinis Frit*, Fall. Var. 3, tibiis tarsisque pallidis." Meigen, vi., p. 157.

Taschenberg ('Naturgesch. d. wirbellosen Thiere,' 1865), describes the following *Muscidæ* as injurious to cereals:—*Chlorops tæniopus*, *C. strigula*, Fabr., *C. lineata*, *C. nasuta*, *C. (Oscinis) Cereris*,* *Oscinis Frit*, *O. pusilla*, and *Siphonella pumilionis*.

Lastly, in the 'Bulletin de la Société impériale des Naturalistes de Moscou' for 1880, No. 3, p. 126, is contained an interesting memoir by Prof. K. Lindeman, upon "Zwei neue dem getreide schädliche Insekten Russlands," namely, 1, *Eurytoma hordei* of Walsh, the larvæ of which produces dilatations on the stems of rye (hence known under the name of the knot-worm); and 2, *Cecidomyia cerealis*, the larva of which appears to be identical with the insect known in North America under the name of the joint-worm.

EXPLANATION OF PLATE XXII.

FIG. 2. *Oscinis avenæ*, Bjerkander, magnified.

2a. Natural size of ditto.

2b. Head of ditto, seen sideways.

2c. Parts of mouth, highly magnified, showing the clavate setose palpi, the acute horny tongue, and the large bilobed lip.

2d. Parts of mouth, highly magnified, displayed by vertical pressure.

2e. Mouth and antenna of ditto, magnified, seen partially sideways.

3. An oat with the outer scales removed.

3a. Ditto, with the inner scales opened, showing the withered plumose style (a), and the empty shell of the *Oscinis* pupa (b).

* *Osc. Cereris*, Fallén, *op. cit.*, p. 5. "Nigra nitida; fronte, pectore, scutelloque albis, pedibus testaceis."

Another species is described by Fallén under the name of *Osc. messoria*, *op. cit.*, p. 5, which is evidently connected with cereal plants:—"Nigra, nitida, capite albo, pectore flavo vario, genubus tarsisque testaceis. Hab. In agris demessis Scaniæ sat frequens."